3-03164-TS

# DEVICE FOR DETECTING VOLTAGE OF BATTERY ASSEMBLY

Patent Number: JP2002156392
Publication date: 2002-05-31
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Requested Patent: JP2002156392
Application Number: JP20000353179 20001120
Priority Number(s):
IPC Classification: G01R19/165; G01R31/36; H01M10/48
EC Classification:
Equivalents:

## Abstract

PROBLEM TO BE SOLVED: To provide a device for detecting a voltage of a battery assembly of a flying capacitor type having small measurement error, while suppressing complicatedness of circuit structure.
SOLUTION: A voltage of a cell is read, using analogue switches 21-29 into capacitors 31 to 34 in parallel for each battery block 11 and 12 of the battery assembly 1. The voltage of stored electricity in the capacitors 31 to 34 is A/D converted in time sequence through analogue switches 41 to 45. Thus, the voltage of each cell can be measured, while securing safety of the circuit by disposing current limiting resistances of a large resistance value between cells 111 to 114, 121 to 124 and analogue switches 21 to 29, and suppressing the measurement error by a simple circuit structure, using the flying capacitor system.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to premature start capacitor type cell voltage detection equipment.
[0002]
[Description of the Prior Art] For example, by the hybrid car, the electric vehicle, and the fuel cell vehicle, it is common to carry out the series connection of many cells which consist of a rechargeable battery or a fuel cell for reduction of wiring ohm loss, the miniaturization of a switching element, etc., and to constitute as the high-pressure group cell several 100V.
[0003] By this high-pressure group cell, the voltage detection equipment which detects the voltage of each cell for the capacity calculation of each cell (it shall be considered on these descriptions that the battery module which comes to carry out the series connection of the cell of the predetermined number is also a cell), or protection management is formed. However, the "cell" as used in this description can be constituted by two or more cell cels by which the series connection was carried out.
[0004] JP,11-248755,A has proposed the voltage detection equipment (henceforth premature start capacitor type cell voltage detection equipment) of the group cell which uses the so-called premature start capacitor and a multiplexer circuit as an example of the voltage detection equipment of the above-mentioned group cell.
[0005] With this premature start capacitor type cell voltage detection equipment, after the voltage of each cell is impressed to a premature start capacitor one by one through the multiplexer of a couple, carry out sample hold of the cell voltage by making both multiplexers into a cut off state, a voltage detector is made to flow through the ends of a premature start capacitor through the analog switch for a capacitor potential output after that, respectively, and it is detected by the voltage detector, the potential difference, i.e., the accumulation-of-electricity voltage, of a premature start capacitor.
[0006]
[Problem(s) to be Solved by the Invention] However, in order that the analog switch of a multiplexer may control a poor short circuit and that act as bad insulation (the poor ground) and a high current flows from a group cell with the above-mentioned conventional premature start capacitor type cell voltage detection equipment, it is desirable practically to connect with each analog switch the current-limiting resistance which has big resistance in a serial.
[0007] However, in order that time amount until the terminal voltage of a capacitor, i.e., a premature start capacitor, reaches cell voltage might long-duration-ize interposition of this current-limiting resistance, it had the problem that time amount required for measurement of total cell voltage increased. However, gross errors will produce buildup of cell voltage measurement time amount in the property of the group cell which caused fluctuation of the operating state of the group cell in this measurement time amount especially current, voltage, temperature, and SOC, and calculated it based on cell voltage, current, etc. which were measured.
[0008] This problem formed two or more capacitors, and increased the number of multiplexers, and

although it was solvable by reducing the number of inputs of each multiplexer **, there was a problem that circuitry was complicated.
[0009] It sets it as the object to offer the voltage detection equipment of the group cell of a premature start capacitor type with a small measurement error, this invention being made in view of the above-mentioned trouble, and inhibiting complication of circuitry.
[0010]
[Means for Solving the Problem] A voltage detector of a group cell for vehicles according to claim 1 In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which were constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A series capacitor circuit which comes to carry out the series connection of a number equal to the number of cells of said cell block of the capacitors, By each aforementioned cell each of said 1st cell block, possible [ charge according to an individual ], while connecting a terminal of each of said cell of said 1st cell block, and a terminal of each of said capacitor according to an individual, each aforementioned capacitor An input analog switch group which connects to a terminal of each of said capacitor in potential a terminal of each aforementioned cell of said 2nd cell block which adjoins a low voltage side to said 1st cell block according to an individual by reverse order with a terminal of said 1st cell block, It is characterized by having an output analog switch group which connects a terminal of each of said capacitor to an input terminal of a voltage detector independently.
[0011] That is, since a juxtaposition capacitor activity premature start capacitor type cell voltage detection method which measures cell voltage of a piece of each block to time amount sequential by capacitor of a piece through a multiplexer is used for this invention, it can end cell voltage measurement promptly compared with the conventional independent capacitor activity premature start capacitor type cell voltage detection method. On the contrary, when all cell voltage measurement time amount of one routine is set constant, since current-limiting resistance of large resistance between a cell and an input analog switch is connectable, circuit safety can be improved.
[0012] With this configuration, furthermore, a terminal of each cell of the 2nd cell block which adjoins a low voltage side to the 1st cell block Since circuitry (henceforth a mirror configuration) connected with a terminal of the 1st cell block according to an individual by reverse order in potential at a terminal of each capacitor is adopted It is not necessary to connect two analog switches to a terminal of the minimum potential edge of the 1st cell block, and circuitry can be simplified compared with a case where the multiplexer of the terminal of each cell of both cell block is carried out to the order of potential.
[0013] When according to the configuration according to claim 2 said voltage detector carries out A/D conversion of the input voltage inputted through said output analog switch group further in voltage detection equipment of a group cell according to claim 1, an A/D-conversion value is calculated and an A/D-conversion value is equivalent to a negative value of cell voltage, it is characterized by performing an operation which changes said A/D-conversion value into a value equivalent to a positive value of said cell voltage.
[0014] According to the above-mentioned mirror configuration, the polarity of accumulation-of-electricity voltage of a capacitor is reversed by case where cell voltage of the 1st cell block is detected, and case where cell voltage of the 2nd cell block is detected. Therefore, if A/D conversion of the accumulation-of-electricity voltage of a capacitor is carried out as it is, it will become the value in which cell voltage of the 1st cell block differs from cell voltage of the 2nd cell block.
[0015] Although what is necessary is to reverse accumulation-of-electricity voltage of a capacitor for every cell block combining an output analog switch, and just to input into a voltage detector, in order to solve this problem, the number of an output analog switch will increase.
[0016] Then, with this configuration, when an A/D-conversion value equivalent to cell voltage is equivalent to a range of a negative value of cell voltage, or a negative value beyond a predetermined value, it changes into an A/D-conversion value with which this cell voltage and absolute value are equivalent to an equal positive value by the operation. This operation can be carried out by easy addition

and subtraction. Namely, what is necessary is to calculate a difference of an A/D-conversion value (digital numeric value) corresponding to a value equivalent to cell voltage 0V understood beforehand, and an A/D-conversion value (digital numeric value) detected this time [ smaller than it ], to add a digital numeric value equivalent to this difference to an A/D-conversion value (digital numeric value) corresponding to a value equivalent to cell voltage 0V, and just to consider as an A/D-conversion value.
[0017] In addition, even when potential of an end of a capacitor is smaller than potential of the other end, and even when an A/D converter is large, A/D conversion of potential of this end is made possible in the fluctuation range of cell voltage. Similarly, when forming amplifier between an output analog switch and an A/D converter, this amplifier is also the same, and even when potential of an end of a capacitor is smaller than potential of the other end, and even when large, amplification of potential of this end is enabled in the fluctuation range of cell voltage.
[0018] Since cell voltage of - can also process by this cell voltage of + outputted from a capacitor by software or a hardware operation of an A/D-conversion value, circuitry simplifies.
[0019] In a suitable mode, after all detection of cell voltage is completed, as for the above-mentioned operation, processing collectively is desirable. Thereby, a gap at the measurement event of each cell voltage can be reduced. In this case, since it is not necessary to process this operation continuously with a cell voltage measurement process by capacitor, measurement time amount required for A/D conversion of each cell voltage of a group cell is not extended.
[0020] A reference potential is impressed to a node of said capacitor of a couple which voltage detection equipment of a group cell according to claim 3 adjoins through an analog switch of said output analog switch group, and said voltage detector is characterized by measuring potential of a different terminal from said node of a capacitor of said couple on the basis of said reference potential.
[0021] That is, according to this configuration, potential of each other end of both capacitors to this reference potential is measured by giving a reference potential to a node of a capacitor of a couple by which the series connection of the one edge each was carried out. Circuitry including a power circuit can be simplified securing [ if it does in this way, ] linearity of a circuit, since the potential difference from a reference potential of a terminal by the side of high potential of a capacitor by the side of high potential can be made small as compared with a case where give a lower order side edge child of a capacitor by the side of low voltage a reference potential, and terminal voltage of both capacitors is measured for example, and input voltage amplitude of latter amplifier or an A/D converter can be reduced.
[0022] According to the configuration according to claim 4, in voltage detection equipment of a group cell according to claim 3, further, said voltage detector carries out A/D conversion of said reference potential to potential of a different terminal from said node of a capacitor of said couple, and a list, respectively, and is characterized by subtracting an A/D-conversion value of said reference potential from an A/D-conversion value of potential of said terminal, and measuring voltage of said cell.
[0023] According to this configuration, since A/D conversion also of node potential, i.e., a reference potential, of a capacitor of a up Norikazu pair is carried out by A/D converter, even if it changes this reference potential and potential of ends of a capacitor of a couple interlocks according to it, fluctuation of a reference potential is cancellable by subtracting A/D conversion of a reference potential from an A/D-conversion value of each potential of ends.
[0024] In a suitable mode of this configuration, reversal of the accumulation-of-electricity direction of accumulation-of-electricity voltage of a capacitor is canceled by calculating an absolute value of a digital signal value of potential of ends of the above-mentioned capacitor. If it does in this way, the accumulation-of-electricity direction of a capacitor can be changed freely, inhibiting complication of circuitry, and lowering of measurement precision.
[0025] In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which voltage detection equipment of a group cell according to claim 5 was constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A capacitor and an input analog switch group which impresses said two or more cell voltage to said capacitor time amount sequential, It has an output analog switch which connects a terminal of each of said capacitor to an input terminal of a voltage detector, and

said voltage detector is characterized by detecting an absolute value of said capacitor voltage.
[0026] Even when the accumulation-of-electricity direction of cell voltage read into a capacitor by time amount sequential becomes reverse according to this configuration, two or more satisfactory exact cell voltage can be detected, and circuitry can be simplified.
[0027] In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which voltage detection equipment of a group cell according to claim 6 was constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A capacitor of the predetermined number which stores electricity cell voltage of said cell block, An input analog switch group which inputs voltage of each aforementioned cell into said capacitor, An output analog switch which outputs accumulation-of-electricity voltage of said capacitor to an input terminal of a voltage detector, It has a current detector which detects current of said group cell, and said current detector is characterized by sampling said current at the substantial turn-off event of said input analog switch. An event of arbitration of an event of turn-on voltage impressed to a control electrode of an input analog switch changing in the direction of a turn-off beyond a predetermined value to an event of on resistance of an input analog switch reaching beyond a predetermined value shall be meant at the substantial turn-off event of an input analog switch here.
[0028] Since according to this configuration current of a group cell is detected in premature start capacitor type cell voltage detection equipment when sample hold of the cell voltage is carried out to a capacitor, an error in a case of calculating conditions (SOC etc.) of a group cell based on these cells voltage and current can be reduced.
[0029] In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which voltage detection equipment of a group cell according to claim 7 was constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A capacitor of the predetermined number which stores electricity cell voltage of said cell block, An input analog switch group which inputs voltage of each aforementioned cell into said capacitor, It has an output analog switch which outputs accumulation-of-electricity voltage of said capacitor to an input terminal of a voltage detector, and a current detector which detects current of said group cell. Said input analog switch group Voltage of each of said cell is inputted into said capacitor to two or more mutually different input timing, and said current detector is characterized by sampling said current to time amount sequential synchronizing with said input analog switch.
[0030] That is, according to this configuration, a capacitor carries out sample hold of the voltage of two or more cells to time amount sequential. In this case, since the above-mentioned substantial turn-off events differ intrinsically, current of a group cell is sampled for every substantial turn-off event.
[0031] And a condition (for example, SOC) of this cell calculates by pair of sample hold and sampled cell voltage, and current at the same event. Thereby, even when performing cell voltage measurement by time-multiplexing processing by multiplexer, voltage measurement timing and current measurement timing do not shift, and it becomes computable [ a cell electrical condition of high degree of accuracy ].
[0032] according to a configuration according to claim 8 -- claim 1 thru/or either of 7 -- in voltage detection equipment of a group cell of a publication, said cell is further characterized by connecting with said input analog switch group through current-limiting resistance.
[0033] Thereby, even if a defect of an input analog switch arises, it can inhibit that excessive current flows in a voltage detection system from a group cell, and circuit safety can be improved.
[0034] According to the configuration according to claim 9, in voltage detection equipment of a group cell according to claim 8, said input analog switch group reads cell voltage into juxtaposition for said every cell block further at said each capacitor, and said output analog switch group is characterized by reading potential of each of said capacitor to time amount sequential in said voltage detector.
[0035] According to this configuration, circuitry can be simplified, inhibiting buildup of cell voltage reading time amount to a capacitor by existence of current-limiting resistance.
[0036]

[Embodiment of the Invention] Hereafter, the following examples explain the suitable mode of this invention to details. However, as for this invention, it is natural that it is not limited to the configuration of the following example and can constitute using a replaceable well-known circuit.
[0037]
[Example] (Circuitry) It explains with reference to the circuit diagram showing the example which applied the voltage detection equipment of the group cell of this invention to voltage detection of the group cell for vehicles in drawing 1 .
[0038] 1 -- a group cell and 2 -- for an output analog switch group and 5, as for a power circuit and 7, a voltage detector and 6 are [ a multiplexer and 3 / a capacitor group and 4 / a current detector and 8 ] current-limiting resistance groups. The current-limiting resistance group 8 consists of current-limiting resistance R1-R8. The group cell 1 has the cell blocks 11 and 12 by which the series connection was carried out, the cell block 11 consists of four cells 111-114 by which the series connection was carried out, and the cell block 12 consists of four cells 121-124 by which the series connection was carried out. The input analog switch 2 consists of analog switches 21-29. The capacitor group 3 consists of capacitors 31-34 by which the series connection was carried out. The output analog switch group 4 consists of analog switches 41-45.
[0039] As for each terminal (a positive-electrode edge or negative-electrode edge) of the cells 111-114 of the cell block 11, the current-limiting resistance R1-R5 is connected to the end of analog switches 21-25 according to the individual through the individual exception.
[0040] As for each terminal (a positive-electrode edge or negative-electrode edge) of the cells 121-124 of the cell block 12, the current-limiting resistance R5-R9 is connected to the end of analog switches 21-25 according to the individual through the individual exception.
[0041] The terminal by the side of the low voltage of a cell 124 (negative-electrode edge) is connected to the terminal 311 of a capacitor 31 through the current-limiting resistance R9 and an analog switch 29. The terminal by the side of the low voltage of a cell 123 (negative-electrode edge) is connected to the terminal 312 of a capacitor 32 through the current-limiting resistance R8 and an analog switch 28. The terminal by the side of the low voltage of a cell 122 (negative-electrode edge) is connected to the terminal 313 of a capacitor 33 through the current-limiting resistance R7 and an analog switch 27. The terminal by the side of the low voltage of a cell 121 (negative-electrode edge) is connected to the terminal 314 of a capacitor 34 through the current-limiting resistance R6 and an analog switch 26.
[0042] The other end of analog switches 21-25 is connected to each terminals 311-315 of capacitors 31-34 according to the individual.
[0043] As described above, the other end of an analog switch 29 is connected to the terminal by the side of the high potential of a capacitor 31, the other end of an analog switch 28 is connected to the terminal by the side of the high potential of a capacitor 32, the other end of an analog switch 27 is connected to the terminal by the side of the high potential of a capacitor 33, and the other end of an analog switch 26 is connected to the terminal by the side of the high potential of a capacitor 34. Since the analog switches 21-24 by the side of high potential and the analog switches 26-29 by the side of low voltage are connected to mirror image relation centering on the analog switch 25 connected to the low voltage side of a capacitor 34, the above-mentioned connection is called "mirror connection" on these descriptions.
[0044] The terminals 311, 313, and 315 of capacitors 31-34 are connected to the input edge 51 of the voltage detector 5 through the analog switches 41, 43, and 45 which constitute a multiplexer according to the individual. The terminals 312 and 314 of capacitors 31-34 are connected to the input edge 52 of the voltage detector 5 through the analog switches 42 and 44 which constitute a multiplexer according to the individual.
[0045] Although the voltage detector 5 has the voltage amplifier of the couple which amplifies the terminal potential of the capacitor inputted into the input edges 51 and 52 on the basis of predetermined reference voltage, and the A/D converter of the couple which carries out A/D conversion of the output signal voltage of these voltage amplifiers according to an individual, since the circuitry of the voltage detector 5 and actuation are not the summaries of this invention and are common knowledge, it omits explanation.

[0046] In addition, the differential amplifier of the terminal voltage of the capacitor inputted into the input edges 51 and 52 may be carried out with the voltage amplifier of the piece of the voltage detector 5, and A/D conversion of the output signal voltage may be carried out.
[0047] A power circuit 6 impresses reference voltage Vref to the input edge 52 of the voltage detector 5, and is impressing the supply voltage VH and VL of positive/negative to the voltage detector 5. supply voltage VH -- a reference potential Vref -- a predetermined value (for example, 5V) -- it is set as a large value -- having -- supply voltage VL -- a reference potential Vref -- a predetermined value (for example, 5V) -- it is set as the small value.
[0048] The current detector 7 has the current sensor 71 which detects the current of the group cell 1, and A/D converter 72 which carries out A/D conversion of the analog current value which the current sensor detected, and A/D converter 72 outputs a digital current signal to a microcomputer 9. Similarly, the digital voltage signal which also detected the voltage detector 5 is outputted to a microcomputer 9.
[0049] A microcomputer 9 calculates SOC of the group cell 1 based on the inputted signal. Moreover, a microcomputer 9 controls the sampling timing of each analog switch or each A/D converter.
[0050] (Actuation) Next, actuation of this circuit is explained below. At first, all analog switches are turned off.
[0051] (Cell voltage measurement of the cell block 11) First, analog switches 21-25 are turned on and the terminal voltage of cells 111-114 is impressed to capacitors 31-34. Analog switches 21-25 are turned off after predetermined time.
[0052] Next, analog switches 41 and 42 are turned on, the A/D converter of the couple of delivery and the voltage detector 5 carries out A/D conversion of them to the input edges 51 and 52 of the voltage detector 5, and makes them a digital voltage signal at them, and the ends potential of a capacitor 31 is held in built-in digital memory temporarily. Of course, you may transmit to a microcomputer 9 immediately.
[0053] Next, an analog switch 41 is turned off, an analog switch 43 is turned on, the A/D converter of the couple of delivery and the voltage detector 5 carries out A/D conversion of them to the input edges 51 and 52 of the voltage detector 5, and makes them a digital voltage signal at them, and the ends potential of a capacitor 42 is held in built-in digital memory temporarily.
[0054] Next, an analog switch 42 is turned off, an analog switch 44 is turned on, the A/D converter of the couple of delivery and the voltage detector 5 carries out A/D conversion of them to the input edges 51 and 52 of the voltage detector 5, and makes them a digital voltage signal at them, and the ends potential of a capacitor 43 is held in built-in digital memory temporarily.
[0055] Next, an analog switch 43 is turned off, an analog switch 45 is turned on, the A/D converter of the couple of delivery and the voltage detector 5 carries out A/D conversion of them to the input edges 51 and 52 of the voltage detector 5, and ends potential of a capacitor 44 is made into a digital voltage signal, and is held in built-in digital memory temporarily, and analog switches 44 and 45 are turned off.
[0056] Next, analog switches 25-29 are turned on and the voltage of cells 121-124 is impressed to capacitors 31-34 according to an individual. Analog switches 25-29 are turned off after predetermined time.
[0057] Next, like the time of cell voltage detection of the cell block 11, analog switches 41-45 are turned on a couple every in time amount sequential, A/D conversion of the accumulation-of-electricity voltage of capacitors 31-34 is carried out by the voltage detector 5, and it is held temporarily. Of course, you may transmit to a microcomputer 9 immediately.
[0058] Next, a total of eight pairs of digital voltage signals held by the voltage detector 5 temporarily are transmitted to a microcomputer 9, and a microcomputer 9 calculates them and asks for each cell voltage.

[0059] Furthermore, if it explains in detail, the voltage of a cell 111 will be computed with the absolute value of the difference of the digital signal of the couple for which it asked by ON of analog switches 41 and 42. Hereafter, each cell voltage is similarly computed with the absolute value of the difference of the pair of the digital signal by which A/D conversion was carried out simultaneously. Of course, if the above-mentioned digital subtraction is performed in the voltage detector 5 and the result is held

temporarily, the momentary hold memory of the voltage detector 5 can be reduced.
[0060] Moreover, when the voltage detector 5 carries out the differential amplifier of the difference of the potential of the couple by which a simultaneous input is carried out to the input edges 51 and 52 with the differential amplifier, after changing into an absolute value the value which carried out the differential amplifier with an analog absolute-value circuit, it is desirable to carry out A/D conversion. This absolute-value circuit may be performed in the following digital circuits. Namely, what is necessary is to search for the difference of the digital signal value which carried out A/D conversion of the value which carried out the differential amplifier, and the digital value with which cell voltage is equivalent to 0V, and just to compute the absolute value of this difference. In addition, it is in the condition which turned off analog switches 41-44, and the digital value with which cell voltage is equivalent to 0V is in the condition which short-circuited the input edges 51 and 42 with the short circuiting switch still more preferably, it performs a differential amplifier with the differential amplifier of the voltage detector 5, and should just carry out A/D conversion of the output voltage.
[0061] In the above-mentioned example, parallel processing of the crowded actuation which reads the cell voltage of the cell block 11 (or 12) to capacitors 31-34 is carried out, and actuation read from capacitors 31-34 is performed to time amount sequential. Since this has formed the current-limiting resistance group 8 of high resistance with high voltage between the group cells 1 and the analog switch groups 2 with a very small output impedance at the time of the above-mentioned reading, It compares with reading taking long duration greatly to the time constant which can be set. In the above-mentioned readout The input impedance of the voltage detector 5 is large, and since A/D conversion can also be extremely carried out by current at high speed, it is for the time amount which the A/D conversion of the accumulation-of-electricity voltage of the capacitor of a piece takes to be very short, and to end. Thereby, high-speed cell voltage measurement is attained, inhibiting complication of circuitry.
[0062] Next, current measurement is explained below.
[0063] In this example, by the command of a microcomputer 9, A/D converter 72 orders A/D converter 72 the sample hold of a current signal after predetermined time (it is in agreement with the difference of the cutoff time delay of analog switches 21-25, and the cutoff time delay of A/D converter 72), after a microcomputer 9 orders analog switches 21-25 OFF. as compared with the cutoff time delay of the sampling switch for the sample hold of an A/D converter, the cutoff time delay of the analog switches 21-24 constituted by the photograph MOS transistor boils this markedly, and it is usually because it is large. The synchronia of a voltage sampling and a current sampling can be secured by this, and the electrical condition of the cell block 11 can be computed to high degree of accuracy using both data.
[0064] Similarly, in this example, by the command of a microcomputer 9, A/D converter 72 orders A/D converter 72 the sample hold of a current signal after predetermined time (it is in agreement with the difference of the cutoff time delay of analog switches 21-25, and the cutoff time delay of A/D converter 72), after a microcomputer 9 orders analog switches 25-29 OFF. as compared with the cutoff time delay of the sampling switch for the sample hold of an A/D converter, the cutoff time delay of the analog switches 25-29 constituted by the photograph MOS transistor boils this markedly, and it is usually because it is large. The synchronia of a voltage sampling and a current sampling can be secured by this, and the electrical condition of the cell block 11 can be computed to high degree of accuracy using both data.
[0065] Furthermore, in this example, a microcomputer 9 uses for electrical condition detection (typically SOC calculation) of the cells 121-124 of the cell block 12 the voltage-current data which carried out [ above-mentioned ] the simultaneous sampling at electrical condition detection (typically SOC calculation) of the cells 111-114 of the cell block 11 using the voltage-current data which carried out [ above-mentioned ] the simultaneous sampling. That is, in this example, a different cell block which measures cell voltage to time amount sequential performs a SOC operation using the current value sampled to different timing. Since the measurement time error of voltage and current is cancelable by this in spite of carrying out a voltage sampling time amount sequential, SOC of each cell is measurable to high degree of accuracy.
[0066] According to the voltage detection equipment of the group cell of this example that gave [ above-

mentioned ] explanation, the various operation effects which gave [ above-mentioned ] explanation can be done so.

[0067] (Deformation mode 1) The complete-change form mode of the voltage detection equipment of the group cell of the above-mentioned example is explained below with reference to drawing 2 .

[0068] in drawing 2 , the voltage detector 5 has one input edge 51, and this input edge 51 has led amplifier -- it is -- a direct A/D converter -- the potential of the terminals 311, 313, and 315 of capacitors 31-34 -- inputting -- criteria [ reference voltage / predetermined in the amplifier or A/D converter of the voltage detector 5 ] -- carrying out -- the potential of each terminals 311, 313, and 315 of capacitors 31-34 -- time order -- a degree -- amplification -- or A/D conversion is carried out.

[0069] The feature of this deformation mode is in the point of inputting a reference potential into the input edge 51 of the voltage detector 5 through an analog switch 46 time amount sequential with the potential of each terminals 311, 313, and 315 of the above-mentioned capacitors 31-34. The other circuit and its actuation are the same as an example.

[0070] If it does in this way, the same operation effect as an example can be done so by circuitry still simpler than the above-mentioned example by calculating the absolute value of the difference of the digital potential of each terminals 311, 313, and 315, and the digital potential of a reference potential.

[0071] (Deformation mode 2) Other deformation modes of the voltage detection equipment of the group cell of the above-mentioned example are explained below with reference to drawing 3 .

[0072] In drawing 3 , the voltage detector 5 has two input edges 51 and 52 like an example. However, in drawing 3 , the differential amplifier of the potential of the input edges 51 and 52, i.e., the terminal voltage of each capacitor, is carried out with time order, next one differential amplifier 53, and A/D conversion is carried out by A/D converter 54.

[0073] And the digital signal outputted from A/D converter 54 is stored temporarily, and is transmitted to a microcomputer 9 after A/D-conversion termination of all cell voltage. In addition, transmission to the microcomputer 9 of this digital signal can also be performed to juxtaposition at the period which reads cell voltage into capacitors 31-34.

[0074] The feature of this mode is in the point of having formed the short circuiting switch 47 which short-circuits the input edges 51 and 52. To predetermined timing, this short circuiting switch 47 is turned on and the digital signal with which cell voltage is equivalent to 0V is outputted from A/D converter 54. Thereby, each cell voltage is measurable with the absolute value of the difference of this 0V equivalent digital signal and other digital signals.

[0075] In addition, although each cell was made into the cell cel piece in the above-mentioned example, of course, you may consider that the battery module which consists of two or more cell cels connected to the serial is a cell.

[0076] In addition, the output analog switch group of the ability of not a photograph MOS transistor but the usual MOS to be used is natural.

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CLAIMS

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[Claim(s)]
[Claim 1] Voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks which are characterized by providing the following, and by which were constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A series capacitor circuit which comes to carry out the series connection of a number equal to the number of cells of said cell block of the capacitors By each aforementioned cell each of said 1st cell block, possible [ charge according to an individual ], while connecting a terminal of each of said cell of said 1st cell block, and a terminal of each of said capacitor according to an individual, each aforementioned capacitor An input analog switch group which connects to a terminal of each of said capacitor in potential a terminal of each aforementioned cell of said 2nd cell block which adjoins a low voltage side to said 1st cell block according to an individual by reverse order with a terminal of said 1st cell block, An output analog switch group which connects a terminal of each of said capacitor to an input terminal of a voltage detector independently
[Claim 2] It is voltage detection equipment of a group cell which carries out A/D conversion of the input voltage as which said voltage detector is inputted through said output analog switch group in voltage detection equipment of a group cell according to claim 1, and is characterized by performing an operation which changes said A/D-conversion value into a value equivalent to a positive value of said cell voltage when an A/D-conversion value is calculated and an A/D-conversion value is equivalent to a negative value of cell voltage.
[Claim 3] It is voltage detection equipment of a group cell which a reference potential is impressed to a node of said capacitor of an adjoining couple through an analog switch of said output analog switch group in voltage detection equipment of a group cell according to claim 1, and is characterized by said voltage detector measuring potential of a different terminal from said node of a capacitor of said couple on the basis of said reference potential.
[Claim 4] It is voltage detection equipment of a group cell which carries out A/D conversion of said reference potential to potential of a terminal with which said voltage detector differs from said node of a capacitor of said couple in voltage detection equipment of a group cell according to claim 3, and a list, respectively, and is characterized by subtracting an A/D-conversion value of said reference potential from an A/D-conversion value of potential of said terminal, and measuring voltage of said cell.
[Claim 5] In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which were constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A capacitor and an input analog switch group which impresses said two or more cell voltage to said capacitor time amount sequential, It is voltage detection equipment of a group cell which is equipped with an output analog switch which connects a terminal of each of said capacitor to an input terminal of a voltage detector, and is characterized by said voltage detector detecting an absolute value of said capacitor voltage.
[Claim 6] In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which were constituted by cell of a large number by which the series connection

was carried out, respectively, and the series connection was carried out mutually A capacitor of the predetermined number which stores electricity cell voltage of said cell block, An input analog switch group which inputs voltage of each aforementioned cell into said capacitor, It has an output analog switch which outputs accumulation-of-electricity voltage of said capacitor to an input terminal of a voltage detector, and a current detector which detects current of said group cell. Said current detector Voltage detection equipment of a group cell characterized by sampling said current at the substantial turn-off event of said input analog switch.

[Claim 7] In voltage detection equipment of a group cell which detects voltage of a group cell with two or more cell blocks by which were constituted by cell of a large number by which the series connection was carried out, respectively, and the series connection was carried out mutually A capacitor of the predetermined number which stores electricity cell voltage of said cell block, An input analog switch group which inputs voltage of each aforementioned cell into said capacitor, It has an output analog switch which outputs accumulation-of-electricity voltage of said capacitor to an input terminal of a voltage detector, and a current detector which detects current of said group cell. Said input analog switch group It is voltage detection equipment of a group cell which inputs voltage of each of said cell into said capacitor to two or more mutually different input timing, and is characterized by said current detector sampling said current to time amount sequential synchronizing with said input analog switch.

[Claim 8] 7 is [ claim 1 thru/or ] voltage detection equipment of a group cell characterized by connecting said cell to said input analog switch group through current-limiting resistance in voltage detection equipment of a group cell of a publication either.

[Claim 9] It is voltage detection equipment of a group cell which said input analog switch group reads cell voltage into juxtaposition for said every cell block in voltage detection equipment of a group cell according to claim 8 at said each capacitor, and is characterized by said output analog switch group reading potential of each of said capacitor to time amount sequential in said voltage detector.

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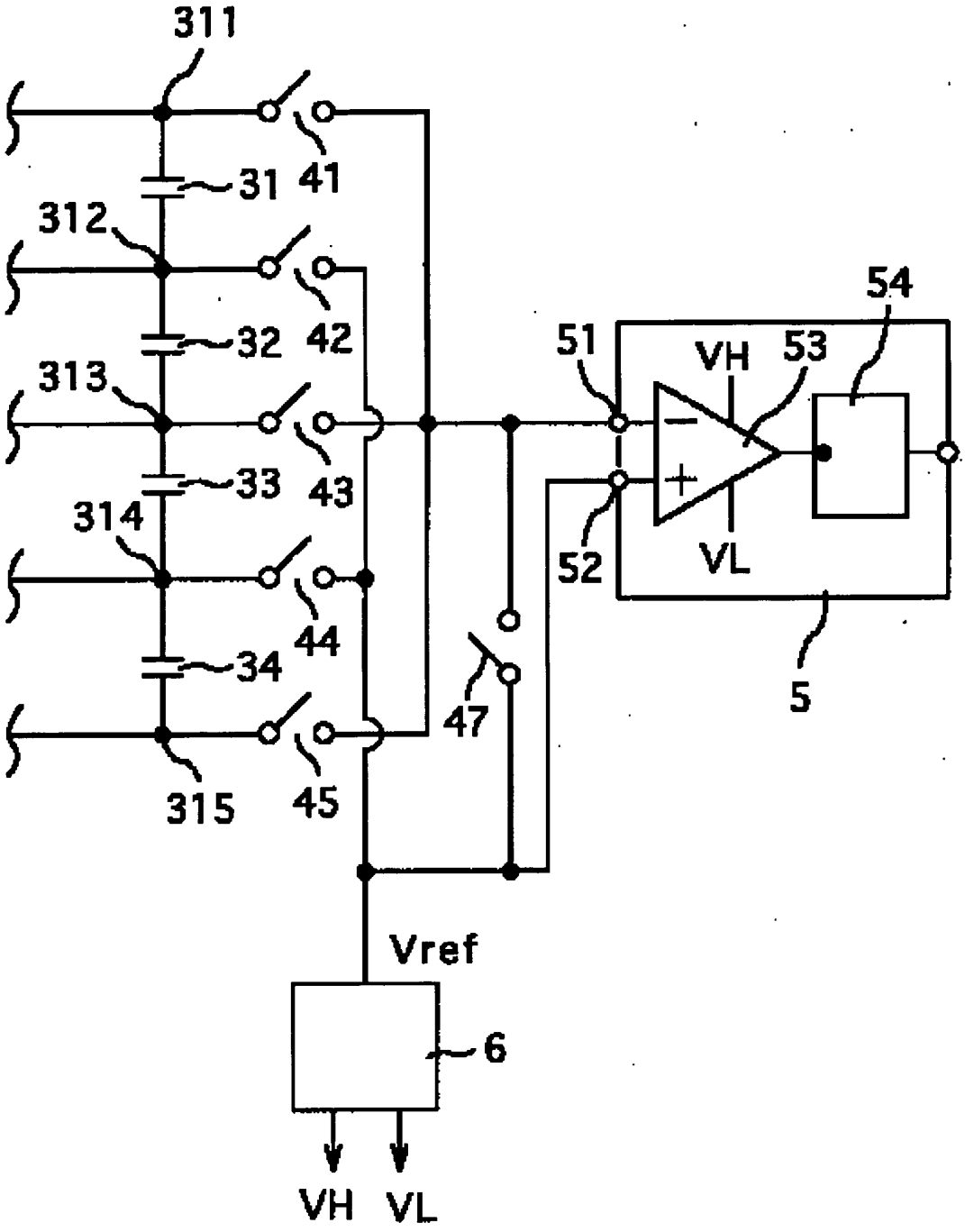
[Translation done.]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